Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer, provided between said first semiconductor layer and said second semiconductor layer, having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm, and having a third refractive index intermediate between said first and second refractive indices~~;~~,

wherein said distributed Bragg reflector is tuned to a wavelength of 1.1 μm or longer.

2. (Original) A distributed Bragg reflector as claimed in claim 1, wherein said material layer has a thickness equal to or larger than 20 nm.

3. (Original) A distributed Bragg reflector as claimed in claim 1, wherein said material layer has a thickness equal to or larger than 30 nm.

4. (Original) A distributed Bragg reflector as claimed in claim 2, wherein said first and second semiconductor layers are formed of any of AlAs, GaAs and AlGaAs, and wherein there is a difference of Al content of less than 80% between said first semiconductor layer

and said second semiconductor layer.

5. (Original) A distributed Bragg reflector as claimed in claim 3, wherein said first semiconductor layer and said second semiconductor layer are formed of any of AlAs, GaAs and AlGaAs, and wherein there is a difference of Al content of 80% or more between said first semiconductor layer and said second semiconductor layer.

6. (Currently Amended) A distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~ said material layer having a thickness smaller than $(50\lambda\text{-}15)$ ~~[~~(nm~~]~~ where λ is a tuned wavelength of the distributed Bragg reflector.

7. (Original) A distributed Bragg reflector as claimed in claim 6, wherein said material layer has a thickness of 20 nm or more.

8. (Original) A distributed Bragg reflector as claimed in claim 6, wherein said material layer has a thickness of 30 nm or more.

9. (Currently Amended) A distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, smaller~~ bandgap;

a second semiconductor layer having a second~~, larger~~ bandgap, said first bandgap smaller than said second bandgap, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer, having a third bandgap intermediate between said first and second bandgaps, provided between said first and second semiconductor layer,

said material layer changing a valence band energy thereof in a thickness direction from said first semiconductor layer to said second semiconductor layer,

said material layer comprising a first layer adjacent to said first semiconductor layer and a second layer adjacent to said second semiconductor layer, and

said first layer and second layer having first and second rates of compositional change such that said first rate being larger than said second rate.

10. (Original) A distributed Bragg reflector as claimed in claim 9, wherein said intermediate layer changes said valence band energy continuously and gradually from said first semiconductor layer to said second semiconductor layer.

11. (Original) A distributed Bragg reflector as claimed in claim 9, wherein said intermediate layer changes said valence band energy stepwise from said first semiconductor layer to said second semiconductor layer.

12. (Original) A distributed Bragg reflector as claimed in claim 9, wherein said intermediate layer comprises a layer in which said valence band energy changes continuously

and a layer in which said valence band energy changes stepwise.

13. (Original) A distributed Bragg reflector as claimed in claim 9, wherein said first and second layers have respective first and second thicknesses, such that said first thickness is smaller than said second thickness.

14. (Original) A distributed Bragg reflector as claimed in claim 9, wherein there is a stepped change of valence band energy at an interface between said first semiconductor layer and said material layer.

15. (Original) A distributed Bragg reflector as claimed in claim 9, wherein said first and second semiconductor layers comprise a material of AlGaAs system.

16. (Currently Amended) A distributed Bragg reflector as claimed in claim 9, wherein said first and second semiconductor layers comprise a material of ~~AlGaAsP~~ AlGaInP system.

17. (Currently Amended) A distributed Bragg reflector as claimed in claim 9, wherein

said first and second semiconductor layers and said intermediate layer have a carrier density of $5 \times 10^{17}cm^{-3}$ - $2 \times 10^{18}cm^{-3}$, ~~and wherein~~

said intermediate layer has a thickness in the rage of 5 - 40 nm, and ~~wherein~~

said intermediate layer is characterized by an average change rate of Al content in the range of 0.02 - ~~0.05~~ 0.15 nm^{-1}.

18. (Currently Amended) A surface-emission laser diode, comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm.

19. (Original) A surface-emission laser diode as claimed in claim 18, wherein said material layer has a thickness equal to or larger than 20 nm.

20. (Original) A surface-emission laser diode as claimed in claim 18, wherein said material layer has a thickness equal to or larger than 30 nm.

21. (Original) A surface-emission laser diode as claimed in claim 19, wherein said first and second semiconductor layers are formed of any of AlAs, GaAs and AlGaAs, and

wherein there is a difference of Al content of less than 80% between said first semiconductor layer and said second semiconductor layer.

22. (Original) A surface-emission laser diode as claimed in claim 20, wherein said first semiconductor layer and said second semiconductor layer are formed of any of AlAs, GaAs and AlGaAs, and wherein there is a difference of Al content of 80% or more between said first semiconductor layer and said second semiconductor layer.

23. (Original) A surface-emission laser diode as claimed in claim 18, wherein said active layer is formed of any of a GaNAs layer, a GaInAs layer, a GaInNAs layer, a GaAsSb layer, a GaInAsSb layer, and a GaInNAsSb layer.

24. (Currently Amended) A surface-emission laser diode, comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer,

at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, <u>said first refractive index larger than said second refractive index,</u> said first and second semiconductor layers being stacked alternately~~,~~; <u>and</u>

a material layer having a <u>third</u> refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness smaller than (50λ-15) ~~[~~(nm~~]~~ where λ is a tuned wavelength of the distributed Bragg reflector.

25. (Original) A surface-emission laser diode as claimed in claim 24, wherein said material layer has a thickness of 20 nm or more.

26. (Original) A surface-emission laser diode as claimed in claim 24, wherein said material layer has a thickness of 30 nm or more.

27. (Original) A surface-emission laser diode as claimed in claim 24, wherein said active layer is formed of any of a GaNAs layer, a GaInAs layer, a GaInNAs layer, a GaAsSb layer, a GaInAsSb layer, and a GaInNAsSb layer.

28. (Currently Amended) A surface-emission laser diode, comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer,

at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, smaller~~ bandgap;

a second semiconductor layer having a second~~, larger~~ bandgap, said first bandgap smaller than said second bandgap, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third bandgap intermediate between said first and second bandgaps, provided between said first and second semiconductor layer,

said material layer changing a valence band energy thereof in a thickness direction from said first semiconductor layer to said second semiconductor layer,

said material layer comprising a first layer adjacent to said first semiconductor layer and a second layer adjacent to said second semiconductor layer, and

said first layer and second layer having first and second rates of compositional change such that said first rate being larger than said second rate.

29. (Original) A surface-emission laser diode as claimed in claim 28, wherein said intermediate layer changes said valence band energy continuously and gradually from said first semiconductor layer to said second semiconductor layer.

30. (Original) A surface-emission laser diode as claimed in claim 28, wherein said intermediate layer changes said valence band energy stepwise from said first semiconductor layer to said second semiconductor layer.

31. (Original) A surface-emission laser diode as claimed in claim 28, wherein said intermediate layer comprises a layer in which said valence band energy changes continuously and a layer in which said valence band energy changes stepwise.

32. (Original) A surface-emission laser diode as claimed in claim 28, wherein said first and second layers have respective first and second thicknesses, such that said first thickness is smaller than said second thickness.

33. (Original) A surface-emission laser diode as claimed in claim 28, wherein there is a stepped change of valence band energy at an interface between said first semiconductor layer and said material layer.

34. (Original) A surface-emission laser diode as claimed in claim 28, wherein said first and second semiconductor layers comprise a material of AlGaAs system.

35. (Currently Amended)) A surface-emission laser diode as claimed in claim 28, wherein said first and second semiconductor layers comprise a material of ~~AlGaAsP~~ AlGaInP system.

36. (Currently Amended) A surface-emission laser diode as claimed in claim 28, wherein said first and second semiconductor layers and said intermediate layer have a carrier density of $5 \times 10^{17}cm^{-3}$ - $2 \times 10^{18}cm^{-3}$, and wherein said intermediate layer has a thickness in the rage of 5 - 40 nm, and wherein said intermediate layer is characterized by an average change rate of Al content in the range of 0.02 - ~~0.05~~ 0.15 nm^{-1}.

37. (Currently Amended) A laser diode array, comprising:

a substrate; and

a plurality of surface-emission laser diodes formed commonly on said substrate, each of said plurality of surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer,

at least one of said upper and lower reflectors comprising a distributed Bragg

reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm.

38. (Currently Amended) A laser diode array, comprising:

a substrate; and

a plurality of surface-emission laser diodes formed commonly on said substrate, each of said surface emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first

and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness smaller than (50λ-15) ~~[~~(nm~~]~~ where λ is a tuned wavelength of the distributed Bragg reflector.

39. (Currently Amended) A surface-emission laser diode array, comprising:

a substrate; and

a plurality of laser diodes, each of said surface-emission laser diodes, comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, smaller~~ bandgap;

a second semiconductor layer having a second~~, larger~~ bandgap, said first bandgap smaller than said second bandgap, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third bandgap intermediate between said first and second bandgaps, provided between said first and second semiconductor layer,

said material layer changing a valence band energy thereof in a

thickness direction from said first semiconductor layer to said second semiconductor layer,

said material layer comprising a first layer adjacent to said first semiconductor layer and a second layer adjacent to said second semiconductor layer, and

said first layer and second layer having first and second rates of compositional change such that said first rate being larger than said second rate.

40. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm.

41. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness smaller than (50λ-15) ~~[~~(nm)~~]~~

where λ is a tuned wavelength of the distributed Bragg reflector.

42. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, smaller~~ bandgap;

a second semiconductor layer having a second~~, larger~~ bandgap, said first bandgap smaller than said second bandgap, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third bandgap intermediate between said first and second bandgaps, provided between said first and second semiconductor layer,

said material layer changing a valence band energy thereof in a thickness direction from said first semiconductor layer to said second semiconductor layer, and

said material layer comprising a first layer adjacent to said first semiconductor layer and a second layer adjacent to said second semiconductor layer,

said first layer and second layer having first and second rates of compositional change such that said first rate being larger than said second

rate.

43. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes provided commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said plurality of surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm.

44. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes formed commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness smaller than $(50\lambda\text{-}15)$ [nm] where λ is a tuned wavelength of the distributed Bragg reflector.

45. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode array comprising a plurality of surface-emission laser

diodes; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, smaller~~ bandgap;

a second semiconductor layer having a second~~, larger~~ bandgap, said first bandgap smaller than said second bandgap, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third bandgap intermediate between said first and second bandgaps, provided between said first and second semiconductor layer,

said material layer changing a valence band energy thereof in a thickness direction from said first semiconductor layer to said second semiconductor layer,

said material layer comprising a first layer adjacent to said first semiconductor layer and a second layer adjacent to said second semiconductor layer, and

said first layer and second layer having first and second rates of compositional change such that said first rate being larger than said second rate.

46. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm.

47. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness smaller than $(50\lambda\text{-}15)$ [nm] where λ is a tuned wavelength of the distributed Bragg reflector.

48. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of

said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, smaller~~ bandgap;

a second semiconductor layer having a second~~, larger~~ bandgap, said first bandgap smaller than said second bandgap, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third bandgap intermediate between said first and second bandgaps, provided between said first and second semiconductor layer,

said material layer changing a valence band energy thereof in a thickness direction from said first semiconductor layer to said second semiconductor layer,

said material layer comprising a first layer adjacent to said first semiconductor layer and a second layer adjacent to said second semiconductor layer, and

said first layer and second layer having first and second rates of compositional change such that said first rate being larger than said second rate.

49. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes provided commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said plurality of surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising

upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm.

50. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes formed commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, larger~~ refractive index;

a second semiconductor layer having a second~~, lower~~ refractive index said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

~~wherein there is provided a material layer having a refractive index intermediate between said first refractive index and said second refractive index,~~

said material layer having a thickness smaller than (50λ-15) ~~[(nm])~~ where λ is a tuned wavelength of the distributed Bragg reflector.

51. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode array comprising a plurality of surface-emission laser diodes; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes,

each of said surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first~~, smaller~~ bandgap;

a second semiconductor layer having a second~~, larger~~ bandgap, said first bandgap smaller than said second bandgap, said first and second semiconductor layers being stacked alternately~~,~~; and

a material layer having a third bandgap intermediate between said first and second bandgaps, provided between said first and second semiconductor layer,

said material layer changing a valence band energy thereof in a thickness direction from said first semiconductor layer to said second semiconductor layer,

said material layer comprising a first layer adjacent to said first semiconductor layer and a second layer adjacent to said second semiconductor layer,

said first layer and second layer having first and second rates of compositional change such that said first rate being larger than said second rate.

52. (Original) An optical transmission/reception system, comprising:

an optical source formed of a surface-emission laser diode device, said surface-emission laser diode comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$

($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm;

an optical fiber transmission path having an end coupled optically to said optical source; and

a photodetection unit coupled to the other end of said optical fiber transmission path,

said optical fiber transmission path being bent between a point A, in which said optical source is provided, and a point B, in which said photodetection unit is provided, such that there is no localized angle formed in said optical fiber transmission path.

53. (Original) An optical transmission/reception system, comprising:

an optical source formed of a surface-emission laser diode device, said surface-emission laser diode comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said

hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0 \leqq y<z<x \leqq 1$) and a thickness of 20 - 50 nm;

an optical fiber transmission path having an end coupled to said optical source;

a photodetection unit coupled to another end of said optical fiber transmission path; and

a mirror provided between a point A, in which said optical source is provided, and a point B, in which said photodetection unit is provided, said mirror changing a direction of propagation of an optical signal transmitted through said optical fiber transmission path.

54. (Original) An optical transmission/reception system for use in an apparatus, comprising:

an apparatus body;

a surface-emission laser diode device provided in said apparatus body as a laser optical source, said laser optical source producing an optical signal;

a photodetection unit provided in said apparatus body, said photodetection unit receiving said optical signal;

a cover member covering a light emitting part of said laser optical source; and

another cover member covering a photodetection part of said photodetection unit,

said surface-emission laser diode comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of

reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm.

55. (Original) An optical telecommunication system, comprising:

a laser diode;

a first optical fiber coupled optically to said laser diode, said first optical fiber being injected with a laser beam produced by said laser diode;

a second optical fiber coupled optically to said first optical fiber, said second optical fiber being injected with an optical signal transmitted through said first optical fiber;

a third optical fiber coupled optically to said second optical fiber, said third optical fiber being injected with an optical signal transmitted through said second optical fiber; and

a photodetector coupled optically to said third optical fiber, said photodetector detecting an optical signal transmitted through said third optical fiber,

said laser diode comprising a surface-emission laser diode chip and comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm;

and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm.

56. (Original) An optical telecommunication system, comprising:

a laser diode;

a first optical fiber coupled optically to said laser diode, said first optical fiber being injected with a laser beam produced by said laser diode;

a second optical fiber coupled optically to said first optical fiber, said second optical fiber being injected with an optical signal transmitted through said first optical fiber;

a third optical fiber coupled optically to said second optical fiber, said third optical fiber being injected with an optical signal transmitted through said second optical fiber,

said laser diode comprising a surface-emission laser diode chip and comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting

optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm,

said first optical fiber having a length of 1 mm or more.

57. (Original) An optical telecommunication system comprising:

a laser diode; and

an optical transmission path coupled optically to said laser diode,

said laser diode comprising a surface-emission laser diode chip and comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a

composition represented as AlzGa1-zAs ($0 \leqq y<z<x \leqq 1$) and a thickness of 20 - 50 nm,

said optical transmission path comprising an optical fiber having a length L, said optical fiber including a core having a diamter D and a clad,

wherein there holds a relationship

$$10^5 \leqq L/D \leqq 10^9.$$

58. (Original) An optical telecommunication system, comprising:

a laser diode,

a mount substrate on which said laser diode is mounted;

said laser diode comprising a surface-emission laser diode chip and comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x \leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0 \leqq y<x \leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0 \leqq y<z<x \leqq 1$) and a thickness of 20 - 50 nm,

wherein a difference of linear thermal expansion coefficient between said laser diode and said substrate is within 2×10^{-6}/K.

59. (Original) An optical telecommunication system, comprising:

a laser diode; and

an optical fiber coupled optically to said laser diode,

said laser diode comprising a surface-emission laser diode chip and comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm,

wherein said optical fiber is mechanically connected to said laser diode in the state that said optical fiber is urged in an axial direction thereof toward a light emitting part of said laser diode.

60. (Original) An optical telecommunication system, comprising:

a laser diode; and

one of an optical fiber and an optical waveguide coupled optically to said laser diode,

said laser diode comprising a surface-emission laser diode chip and comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm,

said optical fiber or said optical waveguide having a core with a diameter X, said laser diode having an aperture d and an optical emission angle θ,

wherein there holds a relationship

$d + 2l\tan(\theta/2)\leqq X$,

where l represents an optical path length from said laser diode to an edge of said optical fiber or optical waveguide.

61. (Original) An optical telecommunication system, comprising:

a laser diode; and

an optical waveguide coupled optically to said laser diode,

said laser diode comprising a surface-emission laser diode chip and comprising: an

active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm; and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm,

wherein there holds a relationship

$0.5 \leqq F/d \leqq 2$

where d represents a diameter of a circle touching internally to an optical emission part of said laser diode and F represents a core diameter of said optical fiber.

62. (Original) An optical telecommunication system, comprising:

a laser diode; and

an optical waveguide coupled optically to a laser chip,

said laser diode comprising a surface-emission laser diode chip and comprising: an active layer of any of a layer containing Ga, In, N and As as major constituent elements thereof and a layer containing Ga, In and As as major constituent elements thereof, said active layer producing optical radiation with a laser oscillation wavelength of 1.1 - 1.7 μm;

and a cavity structure comprising a pair of reflectors provided above and below said active layer, each of said reflectors forming a semiconductor distributed Bragg reflector reflecting optical radiation having a wavelength of 1.1μm or more and comprising an alternate and repetitive stacking of a first material layer of $Al_xGa_{1-x}As$ ($0<x\leqq 1$) and a second material layer of $Al_yGa_{1-y}As$ ($0\leqq y<x\leqq 1$), wherein there is provided a hetero spike buffer layer between said first material layer and said second material layer, said hetero spike buffer layer having a refractive index intermediate between a refractive index of said first material layer and a refractive index of said second material layer, said hetero spike buffer layer having a composition represented as AlzGa1-zAs ($0\leqq y<z<x\leqq 1$) and a thickness of 20 - 50 nm,

said laser diode including an optical emission part having an area S [mm^2], said laser diode being driven with an operational voltage V [volts],

wherein a parameter V/S falls in a range from 15000 to 30000.